

2007-04-12 Sequence Listing-JAMES68.016APC.txt
SEQUENCE LISTING

<110> Bryan, Gregory Thomas
Johnson, Richard
Scott, Barry
Young, Carolyn A.
Tapper, Brian Anthony
Parker, Emily Jane

<120> INDOLE-DITERPENE BIOSYNTHESIS

<130> JAMES68.016APC

<140> US 10/584,429

<141> 2006-06-22

<150> PCT/NZ2004/000333

<151> 2004-12-22

<150> NZ 530331

<151> 2003-12-22

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<170> PatentIn version 3.3

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35 40 45

Ala Leu Pro Ser Lys Asp Ile Arg Ser Gly Leu Thr Asp Ala Ile Asn
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Glu Phe Leu Arg Val Pro Glu Glu Lys Val Leu Val Ile Lys Arg Ile
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Ile Asp Leu Leu His Asn Ala Ser Leu Leu Ile Asp Asp Ile Gln Asp
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Ser Ser Lys Leu Arg Arg Gly Val Pro Val Ala His His Ile Phe Gly
100 105 110

Ile Ala Gln Thr Ile Asn Ser Ala Asn Leu Ala Tyr Phe Ile Ala Gln
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Arg Glu Leu Glu Lys Leu Thr Asn Pro Arg Ala Phe Ala Ile Tyr Asn
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Arg Glu Ser Leu His Cys Pro Thr Glu Asp Glu Tyr Leu Arg Met Ile
165 170 175

Gln Lys Lys Thr Gly Gly Leu Phe Arg Leu Ala Ile Arg Leu Leu Gln
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Gly Glu Ser Ala Ser Asp Asp Asp Tyr Val Ser Leu Ile Asp Thr Leu
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Gly Thr Leu Phe Gln Ile Arg Asp Asp Tyr Gln Asn Leu Gln Ser Asp
210 215 220

Ile Tyr Ser Lys Asn Lys Gly Tyr Cys Glu Asp Leu Thr Glu Gly Lys
225 230 235 240

Phe Ser Tyr Pro Val Ile His Ser Ile Arg Ser Arg Pro Gly Asp Val
245 250 255

Arg Leu Ile Asn Ile Leu Lys Gln Arg Ser Glu Asp Val Met Val Lys
260 265 270

Gln Tyr Ala Val Gln His Ile Glu Ser Thr Gly Ser Phe Ala Phe Cys
275 280 285

Gln Asn Lys Ile Gln Ser Leu Val Glu Gln Ala Arg Glu Gln Leu Ala
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35 40 45

Ile Leu Pro Asn Gly Gly Arg Ile Leu Asp Gln Leu Gly Ile Phe His
50 55 60

Ser Ile Glu Asp Glu Ile Glu Pro Leu Glu Ser Ala Met Met Arg Tyr
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Pro Asp Gly Phe Ser Phe Lys Ser Gln Tyr Pro Gln Ala Leu His Thr
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Ile Leu Tyr Asp Lys Leu Lys Ser Lys Asp Cys Val Phe Thr Asn Lys
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145 150 155 160

Val His Ser Ile Val Arg Ser Glu Ile Trp Arg His Leu Lys Glu Asn
165 170 175

Ser Gln Ile Ser Val Leu Glu Ala Pro Asn Ala Ser Ile Lys His Asp
180 185 190

Tyr Ser Cys Ile Tyr Gly Ile Ser Leu Asn Val Pro Gln Ile Ile Leu
195 200 205

Gly Ile Gln Leu Asn Cys Leu Asp Asp Gly Val Ser Ile His Leu Phe
210 215 220

Thr Gly Lys Gln Ser Lys Leu Phe Trp Phe Val Ile Ile Lys Thr Pro
225 230 235 240

Gln Ala Ser Phe Ala Lys Val Glu Ile Asp Asn Thr His Thr Ala Arg
245 250 255

Cys Ile Cys Glu Gly Leu Arg Thr Lys Lys Val Ser Asp Thr Leu Cys
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Phe Glu Asp Val Trp Ser Arg Cys Thr Ile Phe Lys Met Thr Pro Leu
275 280 285

Glu Glu Gly Val Phe Lys His Trp Asn Tyr Gly Arg Leu Ala Cys Ile
290 295 300

Gly Asp Ala Ile Arg Lys Met Ala Pro Asn Asn Gly Gln Gly Ala Asn
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Met Ala Ile Glu Asp Ala Cys Ser Leu Ala Asn Ile Leu Gln Lys Lys
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Ser Trp Glu Phe Ile Leu Gln Ser Leu Val Tyr Leu Arg Pro Lys Phe
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20

25

30

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35 40 45

Thr Pro Thr Gly Ile Asn Ala Pro Phe Ala Gly Tyr Arg Ser Pro Trp
50 55 60

Glu Pro Pro Leu Leu Val Gln Met Arg Tyr Val Phe Asn Ala Ala Ser
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Ser Arg Tyr Asp Gly Asp Ile Leu Ile Val Pro Pro Arg Tyr Leu Asp
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Asp Leu His Asn Lys Ser Gln Glu Leu Ser Ala Ile Tyr Gly Leu
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Thr Asp Phe Pro Ala Cys Arg Asp Trp Thr Ser Val Ser Val His Pro
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Leu Phe Leu Lys Ala Val Glu Arg Ile Thr His Arg Ile Phe Val Gly
195 200 205

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Ala His Tyr Ala Thr Met Ile Gln Ile Ala Met Arg Ser Val Pro Lys
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Phe Ile Gln Pro Leu Leu Asn Phe Cys Leu Pro Trp Pro Trp Lys Asn
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Ala Ala Cys Val Arg Glu Ala Lys Asn Ala Leu Ile Leu Glu Met Gln
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Asn Asp Leu Leu Gln Ala Val Met Glu Met Ser Ser Pro Ser His Glu
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Asp Ser Gln Leu Asp Val Val Ala Gln Ile Met Leu Thr Met Asn Thr
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Ile Ala Gly His Ser Thr Ala Ala Ser Gly Ala His Ala Leu Phe Asp
 325 330 335

Met Val Ser His Ser Lys Tyr Ile Glu Leu Leu Arg Glu Glu Ala Leu
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Gln Val Phe Arg His Val Glu Leu Arg Val Thr Lys Gln Ala Leu Gly
 355 360 365

Asp Leu Arg Lys Leu Asp Ser Phe Leu Arg Glu Ser Gln Arg His Asn
 370 375 380

Pro Leu Ser Leu Leu Gly Phe Phe Arg Val Val Leu Asp Pro Ala Gly
 385 390 395 400

Ile Thr Leu Gln Asp Gly Thr His Val Pro Tyr Asn Thr Leu Leu Cys
 405 410 415

Val Ala Pro His Ala Ile Ser Asn Asp Pro Asp Val Ile Glu Asp Pro
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Thr Ser Phe Asn Gly Leu Arg Tyr Tyr Glu Gln Arg Cys Arg Asp Ala
 435 440 445

Ser Gln Glu Lys Lys His Gln Tyr Ala Thr Thr Asp Lys Ser His Leu
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His Phe Gly Tyr Gly Thr Trp Ala Cys Pro Gly Arg Phe Leu Ala Ser
 465 470 475 480

Asp Met Leu Lys Val Ile Leu Thr Met Leu Leu Gln Tyr Asp Ile
 485 490 495

Arg Ser Pro Glu Arg Ala Lys Arg Pro Val Ala Gly His Phe His Glu
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Phe Pro Leu Phe Asn Ile Asn Thr Pro Leu Leu Met Lys Arg Arg Asn
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35 40 45

Gly Tyr Glu Arg Thr Ser His Glu Gly Ile Gly Gly Ser Asn Gly Lys
50 55 60

Ile Pro Asp Cys Pro Tyr Ser Tyr Val Ile Ser Leu Tyr Gly His Asn
65 70 75 80

His Phe Ser Pro Leu Val Asp Phe Leu His Pro Thr Leu Lys His Lys
85 90 95

Tyr Pro Lys Lys His Ser Leu Ile Leu Asp Ile Met Asp Ala Val His
100 105 110

Leu Cys Leu Ile Met Val Asp Asp Ile Cys Asp His Ser Pro Lys Arg
115 120 125

Lys Asn His Thr Thr Ala His Leu Leu Tyr Gly Ser Cys Glu Thr Ala
130 135 140

Asn Arg Ala Tyr Phe Val Leu Thr Lys Val Ile Asn Arg Ala Met Lys
145 150 155 160

Glu Gln Pro Val Leu Gly Ile Glu Leu Leu Arg Ala Leu Glu Leu Ile
165 170 175

Leu Glu Gly Gln Asp Met Ser Leu Val Trp Arg Arg Asp Gly Leu Arg
180 185 190

Ser Phe Glu Ser Tyr Gly Glu Glu Ser Leu Leu Thr Tyr Lys Asn Met
195 200 205

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210 215 220

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225 230 235 240

Tyr Ala Gln Leu Gln Asn Asp Cys Lys Asn Ile Tyr Ser Glu Glu Tyr
245 250 255

Ala Phe Asn Lys Gly Thr Val Ala Glu Asp Leu Arg Asn Arg Glu Leu
260 265 270

Ser Phe Pro Val Val Val Ala Leu Asn Asp Lys His Thr Glu Pro Gln
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280

285

Ile Arg Lys Ala Phe Gln Ser Gln Asn Gln Gly Asp Ile Lys Arg Ala
 290 295 300

Leu Gln Ala Leu Glu Ser Pro Ser Val Lys Asn Thr Cys Leu Lys Thr
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gtcggattct gctcgagatg gattttaagc tagatagtga gtttccgtcg cggcgccctc	1740
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 <211> 498
 <212> PRT
 <213> Neotyphodium lolii

<400> 10

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 1 5 10 15

Tyr Val Val Tyr Gly Thr Lys Arg Lys Glu Cys Ile Pro Thr Ile Arg
 20 25 30

Arg Trp Pro Arg Leu Leu Pro Gln Phe Leu Asp Arg Leu Ser Tyr Asn
 35 40 45

Asp His Ala Ala Arg Leu Val Lys His Gly Tyr Glu Lys His Lys Asn
 50 55 60

Gln Pro Phe Arg Leu Leu Lys Met Asp Met Asp Leu Ile Val Ile Pro
 65 70 75 80

Leu Gln Tyr Ala Leu Glu Leu Arg Ala Val Thr Ser Asp Lys Leu Asp
 85 90 95

Pro Leu Thr Ala Ser Phe Asp Asp Asn Ala Gly Lys Val Thr Arg Ile
 100 105 110

Leu Leu Gly Ser Glu Leu His Thr Arg Ala Ile Gln Gln Arg Leu Thr
 115 120 125

2007-04-12 Sequence Listing-JAMES68.016APC.txt

Pro Lys Leu Pro Gln Thr Leu Pro Val Leu Leu Asp Glu Leu Asn His
130 135 140

Ala Phe Gly Gln Val Leu Pro Ala Gly Asn Asp Gly Ser Asn Ala Trp
145 150 155 160

Ile Ser Val Asn Pro Tyr Glu Leu Val Leu Asn Leu Ala Thr Arg Ala
165 170 175

Thr Ala Arg Leu Phe Val Gly Asp Leu Ile Cys Arg Asn Glu Ile Phe
180 185 190

Leu Glu Thr Thr Ala Ser Phe Ser Arg Asn Thr Phe Asp Thr Ile Ser
195 200 205

Thr Ser Arg Ser Phe Gly Asn Leu Phe Thr His Tyr Phe Ala Arg Trp
210 215 220

Ile Ser Thr Ala Lys Glu Ala His Gly Gln Leu Gln Tyr Ile Gln Asn
225 230 235 240

Leu Leu Gly Ser Glu Val Gln Arg Arg Lys Leu Asn Ser Glu Glu Lys
245 250 255

His Asp Asp Phe Leu Gln Trp Cys Thr Glu Leu Ala Val Thr Glu Asp
260 265 270

Glu Ala Arg Pro Glu Ala Leu Ala His Arg Thr Leu Gly Ile Leu Ser
275 280 285

Met Ala Val Ile His Thr Thr Ala Met Ala Leu Thr His Ile Leu Phe
290 295 300

Asp Met Ile Ser Asp Asp Ser Leu Lys Glu Ser Leu Arg Arg Glu Gln
305 310 315 320

Gln Asn Val Leu Lys His Gly Trp Thr Glu Ile Thr Gln Gln Thr Met
325 330 335

Leu Asp Met Lys Gln Leu Asp Ser Leu Met Arg Glu Ser Gln Arg Ile
340 345 350

Asn Pro Val Gly Glu Phe Thr Phe Arg Arg Ile Val Arg Glu Arg Ile
355 360 365

Thr Leu Ser Asp Gly Tyr Gln Leu Gln Pro Gly Gln Gln Ile Ala Ile
370 375 380

2007-04-12 Sequence Listing-JAMES68.016APC.txt

Pro Ala Lys Cys Ile Asn Thr Asp Ser Thr Lys Leu Ser Asp Ala His
385 390 395 400

Leu Phe Gln Pro Phe Arg Trp Leu Lys Gln Ser Gly Thr Ala Thr Thr
405 410 415

Ser Phe Ser Asn Ser Ser Ala Leu Asn Leu His Phe Gly Phe Gly Arg
420 425 430

Tyr Ala Cys Pro Gly Arg Phe Ile Ala Ser Tyr Met Ile Lys Ala Ile
435 440 445

Met Ser Arg Ile Leu Leu Glu Tyr Asp Phe Lys Leu Asp Ser Glu Phe
450 455 460

Pro Ser Arg Arg Pro Pro Asn Ile Val His Gly Asp Lys Ile Leu Pro
465 470 475 480

Asn Arg Asn Ala Val Val Leu Leu Arg Arg Leu Glu Lys Thr Val Thr
485 490 495

Val Cys

<210> 11
<211> 1945
<212> DNA
<213> Neotyphodium lolii

<400> 11
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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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cagacgctgg taagaggacg agctgttacg tatgacctt ttcttcggtg aaaactaacg	960
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<210> 12
 <211> 525
 <212> PRT
 <213> Neotyphodium lolii

<400> 12

Met Ala Phe Ala Ser Leu Leu His His Ile Trp Asn His Ala Val Asp
 1 5 10 15

Cys Ala Glu Gln Leu Thr Trp Trp Gln Thr Ile Val Ser Phe Ile Ile
 20 25 30

Phe Cys Ile Met Cys Ser Trp Leu Pro Gly Asn Gly Glu Met Arg Ala
 35 40 45

2007-04-12 Sequence Listing-JAMES68.016APC.txt

Pro Phe Val Gly Tyr Arg Trp Pro Phe Glu Pro Thr Phe Trp Val Arg
50 55 60

Met Arg Phe Ile Phe Gln Ser Leu Gly Met Met Thr Glu Gly Tyr Ser
65 70 75 80

Lys Phe Lys Asp Ser Met Phe Lys Ile Thr Thr Asn Asp Ala Asp Trp
85 90 95

Leu Val Leu Ser Gln Arg Tyr Leu Asp Asp Leu Gln Ser Leu Pro Ala
100 105 110

Glu Arg Leu Ser His Thr Asp Ala Leu Val Thr Met Trp Gly Ser Ser
115 120 125

His Ser Pro Phe Ala Leu Leu Asn Lys Ser Asp Leu Ser Ser Arg Ala
130 135 140

Leu Arg Asp Val Val Ala Pro Asn Tyr Ala Lys Asp Leu Asp Ser Leu
145 150 155 160

Val Asp Glu Leu Arg Tyr Ser Leu Glu His Asp Ile Asp Ile Gln Asp
165 170 175

Asp Trp Lys Pro Ile Asp Ala Leu Glu Leu Ser Ser Lys Leu Val Leu
180 185 190

Arg Ile Ser Gln Arg Ile Leu Ile Gly Trp Pro Met Ser Arg Asp Gln
195 200 205

Glu Leu Leu Glu Cys Ala Gln Gly Tyr Ala Asp Ala Ala Thr Val Val
210 215 220

Gln Phe Ala Leu Lys Leu Leu Pro Arg Gln Ile Arg Pro Leu Val Tyr
225 230 235 240

Pro Leu Leu Pro Gln Ala Trp Ala Thr Lys Ser Trp Ile Arg Arg Cys
245 250 255

Asp Lys Ile Leu Ala Lys Glu Met Gln Arg Arg Gln Val Leu Glu Lys
260 265 270

Ser Asp Pro Val Tyr Glu Lys Pro Lys Asp Leu Leu Gln Gly Met Val
275 280 285

Asp Leu Glu Pro Ser Arg Pro Val Asp Lys Leu Gly His Asp Phe Leu
290 295 300

2007-04-12 Sequence Listing-JAMES68.016APC.txt

Val Gln Ala Leu Ile Ser Arg Met Ala Pro Val Val Thr Met Ala Gln
 305 310 315 320

Thr Leu Val Asp Leu Ala Leu His Pro Glu Asp Ile Glu Glu Leu Arg
 325 330 335

Asp Glu Val Leu Gln Val Ile Gly Pro Asp Gly Ala Gly Leu Gly Asn
 340 345 350

Leu Arg Gln Ser Phe Thr Lys Leu Asp Lys Met Asp Ser Val Leu Arg
 355 360 365

Glu Ser Ala Arg Phe Thr Pro Leu Ser Met Met Thr Met His Arg Arg
 370 375 380

Val Gln Asp Ala Lys Gly Ile Thr Leu His Asp Gly Val His Leu Pro
 385 390 395 400

Arg Gly Thr His Val Ala Phe Pro Ala Tyr His Ile Gly Arg Asp Pro
 405 410 415

Lys Leu Val Ser Gly Ala Asp Ile Tyr Asp Gly Leu Arg Trp Tyr Arg
 420 425 430

Lys Asp Leu Gly Glu Ala Gln Glu Asn Glu Ala Pro Lys His Arg Phe
 435 440 445

Val Thr Pro Asp Ser Asn Tyr Leu Thr Phe Gly Ser Gly Lys Tyr Val
 450 455 460

Cys Pro Gly Arg Phe Ile Ala Glu His Met Leu Lys Leu Met Met Thr
 465 470 475 480

Ala Val Leu Leu Arg Tyr Glu Phe Lys Trp Pro Pro Gly Val Pro Val
 485 490 495

Pro Glu Gln Gln Tyr Arg His Val Phe Ala Tyr Pro Ser Lys Thr Thr
 500 505 510

Leu Leu Ile Lys Arg Arg Lys Asp Gly Asp Gln Ile Leu
 515 520 525

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 <211> 2014
 <212> DNA
 <213> Neotyphodium tolii

<400> 13

2007-04-12 Sequence Listing-JAMES68.016APC.txt

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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<210> 14
<211> 537
<212> PRT
<213> Neotyphodium lolii

<400> 14

Met Lys Met Leu Thr Glu His Phe Asp Phe Pro Lys Leu Asn Phe Ala
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Thr Ile Val Ile Ser Gly Ala Thr Ile Ile Gly Ile Ile Phe Leu Arg
20 25 30

Tyr Leu Asn Tyr Pro Thr Lys Val Asn Val Pro Val Val Gly Ile Gly
35 40 45

Val Arg Tyr Thr Lys Trp Leu Ala Ala Ile Ile Asn Val Arg His Ala
50 55 60

Arg Gln Ser Ile Arg Glu Gly Tyr Ala Lys Tyr Gly Asp Phe Ala Phe
65 70 75 80

Gln Ile Pro Thr Met Thr Arg Met Glu Val Phe Ile Cys Asp Arg Gln
85 90 95

Met Thr Arg Glu Tyr Gln Asn Val Asp Asp Tyr His Leu Ser Phe Arg
100 105 110

Ala Val Met Thr Glu Glu Phe Gln Phe Lys Trp Leu Leu Pro Gly Gln
115 120 125

Ala His Glu Ala Arg Ile Ile Pro Asn Ser Val Ile Ala Lys Ala Leu
130 135 140

Ser Trp Gln Arg Thr Arg Ala Asn Lys Pro Ser Asp Pro Phe Phe Glu
145 150 155 160

Ser Phe Ser Ala Glu Phe Met Gln Gly Phe Gln Glu Glu Met Arg Arg
165 170 175

Leu Ile Gln Tyr Gln Asn Ser Ser Val Met Ser Asn Arg Ser Gly Ala
180 185 190

Val Leu Asp Pro Ala His Gly Trp His Ala Val Pro Cys Phe Pro Leu
195 200 205

2007-04-12 Sequence Listing-JAMES68.016APC.txt

Ala Leu Lys Val Ile Gly Arg Leu Thr Thr Tyr Val Leu Phe Gly Lys
210 215 220

Pro Leu Cys Gln Asp Ala Thr Phe Leu Asn Met Cys Cys Gln Phe Gly
225 230 235 240

Asp Val Ile Pro Arg Asp Ala Ile Ile Leu Arg Ser Trp Pro Ala Leu
245 250 255

Ala Arg Pro Leu Ile Val Lys Ile Leu Ser Ala Pro Arg Val Met Gly
260 265 270

Lys Leu Arg Asn Ile Leu Ile Val Glu Ile Lys Ser Arg Arg Glu Ser
275 280 285

His Glu Thr Asn Pro Met Ser Asp Ile Leu Asp Phe Thr Met Ala Trp
290 295 300

Val Asp Arg His Pro Asn Ala Ser Phe Asp Asp Gln His Ile Ala Glu
305 310 315 320

Met Met Ile Asn Thr Ile Phe Ala Ala Leu His Thr Ser Ser Gln Leu
325 330 335

Val Val His Thr Ile Phe Glu Leu Ala Ser Arg Pro Glu Tyr Ser Asp
340 345 350

Ala Leu Leu Glu Glu Ile Asp Ala Cys Phe Glu Lys His Gly Lys Gly
355 360 365

Thr Lys Ala Ala Leu Asp Ser Met Phe Lys Val Asp Ser Phe Ile Lys
370 375 380

Glu Thr Gln Arg Phe Asn Pro Leu Asp Ala Ser Ala Leu Ala Arg Leu
385 390 395 400

Ala Leu Lys Asp Phe Thr Phe Ser Asn Gly Leu Asn Ile Pro Lys Gly
405 410 415

Ser Val Ile Phe Thr Pro Asn Ser Pro Ile Phe Glu Asp Glu Arg Tyr
420 425 430

Tyr Lys Asp Pro Lys Val Phe Asp Gly Phe Arg Phe Ala Arg Met Arg
435 440 445

Asn Asp Pro Lys Leu Gly Leu Phe Cys Asp Leu Thr Ala Thr Asn Glu
Page 21

450

455

460

Gln Ser Met His Phe Gly Thr Gly Arg His Ala Cys Pro Gly Arg Phe
465 470 475 480

Met Val Ser Asp Glu Val Lys Leu Ala Val Ile His Ile Leu Ser Asn
485 490 495

Phe Asp Phe Cys Ile Glu Asn Phe Gly Pro Arg Pro Ala Asn Gln Pro
500 505 510

Phe Gly Lys Phe Leu Leu Pro Asp Met Ser Ala Lys Ile Trp Leu Arg
515 520 525

Glu Lys Arg Ala Arg Glu Lys Asn Leu
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<210> 15

<211> 1496

<212> DNA

<213> Neotyphodium lolii

<400> 15

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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<210> 16
 <211> 439
 <212> PRT
 <213> Neotyphodium lolii

<400> 16

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Ala Leu Asp Ile Leu Tyr Trp Lys Asn His Cys Ile Lys Gln Leu Glu
 20 25 30

Ser Leu Leu Cys Ala Thr Asp Ser Tyr Cys Thr Ala Asp Lys Ala Ala
 35 40 45

Gln Leu Arg Ile Leu Ser Glu Leu Val Leu Pro Asn Leu Gly Pro Arg
 50 55 60

Pro Ser Asn Ala Thr Gly Pro Ser Tyr Leu Thr Arg Ser Gly Ser Pro
 65 70 75 80

Ile Met Leu Ser Leu Asn Thr Thr Ser Ser Lys Asn Cys Val Arg Tyr
 85 90 95

Cys Trp Glu Ile Leu Gly Ala Thr Gly Ala Ser Asn Asp Asp Pro Leu
 100 105 110

Ala Val Gln Val Ala Lys Asp Val Val Ala Ser Leu Ser Ala Thr Phe
 115 120 125

Arg Leu Ser Thr Lys Trp Ser Glu Thr Leu Leu Ser Asn Phe Ala Val
 130 135 140

Thr Pro Asp Gln Ala Arg Gln Val Ile Asn Met Leu Pro Glu Trp Ile
 145 150 155 160

2007-04-12 Sequence Listing-JAMES68.016APC.txt

Gln Gly Phe Val Pro Glu Gly Met Glu Cys Asp Phe Pro Lys Arg Ile
165 170 175

Pro Phe Ala Met Thr Ser Phe Asp Leu Asn Gly Ser Asn Val Ala Met
180 185 190

Lys Leu Tyr Val Asn Pro Arg Val Lys Glu Ile Leu Thr Gly Thr Pro
195 200 205

Ser Ser Asp Leu Val Trp Glu Phe Leu Arg Asn Leu Thr Pro Glu Met
210 215 220

Lys Pro Arg Ala Val Asp Leu Leu Glu Arg Phe Ile Thr Asp Asn Ser
225 230 235 240

Gly Pro Ser Ala Ile Glu Leu Val Gly Ile Asp Cys Val Asp Asp Ala
245 250 255

His Leu Ser Asn Ala Arg Val Lys Leu Tyr Val His Thr Met Ser Ser
260 265 270

Ser Phe Asn Thr Val Lys Asn Tyr Val Thr Leu Gly Gly Ala Ile Trp
275 280 285

Asp Glu Gln Thr Gln Lys Gly Leu Gly Ile Leu Gln Ser Ile Trp His
290 295 300

Leu Leu Leu Gln Glu Pro Glu Gly Ile Ser Asp Asn Gly Phe Asp Lys
305 310 315 320

Pro Val Asn Asp Ser Ser Met Leu Cys Gln Lys Leu Tyr Phe Ser Phe
325 330 335

Glu Leu Arg Pro Gly Thr Asp Phe Pro Gln Val Lys Thr Tyr Val Pro
340 345 350

Thr Trp Asn Tyr Leu Arg Thr Asp Gly Glu Thr Ile Gln Asn Tyr Glu
355 360 365

Ala Ile Phe Arg Ala Cys Asp His Pro Trp Gly Glu Asp Arg Thr Tyr
370 375 380

Gly Lys Ile Phe Gln Asp Ala Phe Gly Pro Ala Thr Glu Ser Arg Lys
385 390 395 400

Lys Pro Ile His Cys Asp Ala Ser Phe Leu Phe Thr Glu Glu Thr Gly
405 410 415

2007-04-12 Sequence Listing-JAMES68.016APC.txt

Val Tyr Gln Thr Leu Tyr Phe Ser Pro Pro Ile Glu Gly Glu Thr Glu
420 425 430

Val Gln Ser Asn Leu Val Ala
435

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<211> 1110
<212> DNA
<213> Epichloe festucae

<400> 17
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<400> 18

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      35      40      45
Ala Leu Pro Ser Lys Asp Ile Arg Ser Gly Leu Thr Asp Ala Ile Asn
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Glu Phe Leu Arg Val Pro Glu Glu Lys Val Leu Val Ile Lys Arg Ile
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Ile Asp Leu Leu His Asn Ala Ser Leu Leu Ile Asp Asp Ile Gln Asp
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Ser Ser Lys Leu Arg Arg Gly Val Pro Val Ala His His Ile Phe Gly
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Gln Lys Lys Thr Gly Gly Leu Phe Arg Leu Ala Ile Arg Leu Leu Gln
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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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Gln Tyr Ala Val Gln His Ile Glu Ser Thr Gly Ser Phe Ala Phe Cys
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Gln Asn Lys Ile Gln Ser Leu Val Glu Gln Ala Arg Glu Gln Leu Ala
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Arg Val Val Ser Ile Ala Ser Gly Gln Asp Lys Val Thr Ala Lys Thr	
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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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Tyr Ser Cys Ile Tyr Gly Ile Ser Leu Asn Val Pro Gln Ile Ile Leu
195 200 205

Gly Ile Gln Leu Asn Cys Leu Asp Asp Gly Val Ser Ile His Leu Phe
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Thr Gly Lys Gln Ser Lys Leu Phe Trp Phe Val Ile Ile Lys Thr Pro
225 230 235 240

Gln Ala Ser Phe Ala Lys Val Glu Ile Asp Asn Thr His Thr Ala Arg
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Cys Ile Cys Glu Gly Leu Arg Thr Lys Lys Val Ser Asp Thr Leu Cys
260 265 270

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Glu Glu Gly Val Phe Lys His Trp Asn Tyr Gly Arg Leu Ala Cys Ile
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Leu Leu Gly Arg Tyr Leu Ile Pro Phe Leu Tyr Asp Ala Pro Ala Gly
385 390 395 400

2007-04-12 Sequence Listing-JAMES68.016APC.txt

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Ser Trp Glu Phe Ile Leu Gln Ser Leu Val Tyr Leu Arg Pro Lys Phe
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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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Ile Val Ala Leu Leu Val Leu Ile Val Cys Ile Phe Leu Tyr Trp Arg
 35 40 45

Thr Pro Thr Gly Ile Asn Ala Pro Phe Ala Gly Tyr Arg Ser Pro Trp
 50 55 60

Glu Pro Pro Leu Leu Val Gln Met Arg Tyr Val Phe Asn Ala Ala Ser
 65 70 75 80

Met Ile Arg Glu Gly Tyr Ala Lys Trp Lys Ser Leu Phe Gln Ile
 Page 31

Ser Arg Tyr Asp Gly Asp Ile Leu Ile Val Pro Pro Arg Tyr Leu Asp
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Asp Leu His Asn Lys Ser Gln Glu Glu Leu Ser Ala Ile Tyr Gly Leu
115 120 125

Ile Arg Asn Phe Gly Gly Ser Tyr Ser Gly Ile Thr Leu Leu Gly Glu
130 135 140

Asn Asp Val Gly Ile Arg Ala Leu Gln Thr Lys Ile Thr Pro Asn Leu
145 150 155 160

Ala Lys Leu Cys Asp Asp Ile Arg Asp Glu Phe Gln Tyr Cys Leu Asp
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Thr Asp Phe Pro Ala Cys Arg Asp Trp Thr Ser Val Ser Val His Pro
180 185 190

Leu Phe Leu Lys Ala Val Glu Arg Ile Thr His Arg Ile Phe Val Gly
195 200 205

Leu Pro Leu Cys Arg Asn Pro Gln Trp Val Gln Ala Thr Ser Lys His
210 215 220

Ala His Tyr Ala Thr Met Ile Gln Ile Ala Met Arg Ser Val Pro Lys
225 230 235 240

Phe Ile Gln Pro Leu Leu Asn Phe Cys Leu Pro Trp Pro Trp Lys Asn
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Arg Arg Arg Asn Leu Glu Lys Val Asn Ser Phe Asp Tyr Ile Lys Ser
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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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370 375 380

Pro Leu Ser Leu Leu Gly Phe Phe Arg Val Val Leu Asp Pro Ala Gly
385 390 395 400

Ile Thr Leu Gln Asp Gly Thr His Val Pro Tyr Asn Thr Leu Leu Cys
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Val Ala Pro His Ala Ile Ser Asn Asp Pro Asp Val Ile Glu Asp Pro
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Thr Ser Phe Asn Gly Leu Arg Tyr Tyr Glu Gln Arg Cys Arg Asp Ala
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Ser Gln Glu Lys Lys His Gln Tyr Ala Thr Thr Asp Lys Ser His Leu
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His Phe Gly Tyr Gly Thr Trp Ala Cys Pro Gly Arg Phe Leu Ala Ser
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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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 <213> Neotyphodium lolii

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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<223> y is t or c

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<220>
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<222> (4)..(4)
<223> m is a or c

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<220>
<221> misc_feature
<222> (6)..(6)
<223> n is a, c, g, or t

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20

<210> 27

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<210> 34
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gccaacacaa gtgctctacg caggaaccag ccggccgccc atgttgtttt tggggagacg    240
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35 40 45

Ala Val His Phe Ser Ala Ile Leu Ile Asp Asp Ile Ala Asn Gln Ser
50 55 60

Ala Leu Arg Arg Asn Gln Pro Ala Ala His Val Val Phe Gly Glu Thr
65 70 75 80

Glu Thr Ala Thr Arg Ala Tyr Leu Val Leu Arg Val Val Asn Arg
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Thr Met Arg Glu Asn Pro Val Leu Ala Gly Glu Leu Leu Asn Ser Leu
100 105 110

Glu Glu Ile His Gln Gly Gln Asp Glu Ser Leu Val Trp Arg Arg Asp
115 120 125

Gly Leu Glu Thr Phe Pro Val Ala Asp Asp Glu Arg Leu Ala Ala Tyr
130 135 140

Val Arg Met Ser Arg Leu Lys Thr Gly Ser Leu Phe Val Leu Leu Gly
145 150 155 160

Arg Leu Leu Ala Asn Gly Gly Thr Glu Phe Asp Asp Leu Leu Val Arg
165 170 175

Phe Gly Leu Tyr Ala Gln Leu Gln Xaa Asp Cys Lys Asn Ile Tyr Ser
180 185 190

Pro Glu Tyr Ala Leu Asn Lys Gly Ser Val Ala Glu Asp Leu Arg Asn
195 200 205

Gly Glu Leu Ser Tyr Pro Val Val Val Ala Leu Ile Glu Asn Lys Ala
210 215 220

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Glu Gly Ile Val Gly Glu Ala Leu Arg Thr Arg Ser Asp Gly Asp Thr
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Glu Gln Ala Leu Arg Val Leu Glu Ser Pro Ala Val Lys Asp Ala Cys
 245 250 255

Leu His Ala Leu Glu Ala Ala Ser Val Gly Leu Glu Asp Leu Val Glu
 260 265 270

Ala Trp Gly Arg Arg Glu Lys Met Arg Ser Asp Thr Leu Asp Gly Asp
 275 280 285

Asp Leu Thr Arg Pro Ser Thr Ile Thr Gln His Glu Gln Asp Asp His
 290 295 300

Val Asp Arg Ala Ala Ile Asp Ala Lys Ser Asp Ala Ser Gly Ser Ser
 305 310 315 320

Asn Lys Ser Leu Thr Pro Pro Glu Thr Ala Pro Thr Thr Asp Thr Leu
 325 330 335

Ser Glu Thr Ala Val Gly Asp Ile Ser Ser Val Asp Val Asp Tyr Trp
 340 345 350

Thr Arg Arg Cys Val Pro Ile Ile Gly Ser Leu Leu Lys Ser Cys Arg
 355 360 365

Val Tyr Ser Glu Ala Glu Arg Glu Thr Gln Leu Arg Phe Leu Gln Glu
 370 375 380

His Val Leu Pro Asn Leu Gly Pro Arg Pro Ser Ser Pro Gly Ser Gln
 385 390 395 400

Ile Gln Ser Met Ala Thr Phe Ser Gly Phe Pro Leu Gln Pro Ser Ile
 405 410 415

Asn Leu Ser Gly Ser Gly Gln Ala Lys Val Arg Tyr Thr Phe Glu Pro
 420 425 430

Leu Asp Ser Leu Ser Gly Thr Glu Val Asp Pro Phe Ala Leu Ala Pro
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Ala Gln Arg Val Leu Glu Lys Leu Ser Thr Leu Leu Gly Val Trp Pro
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Gly Trp Ile Asp Ala Leu Ile Ala Ala Tyr His Pro Thr Arg Glu Glu
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2007-04-12 Sequence Listing-JAMES68.016APC.txt

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485 495

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515 520 525

Leu Lys Val Tyr Phe Asp Pro Lys Ile Lys Glu Ala Val Thr Gly Ile
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Pro Ser Cys Lys Tyr Thr Cys Gln Ile Leu Arg Thr Val Asp Arg Phe
545 550 555

Gly Asn Ala Lys Ala Val Asp Met Leu Glu Gln Phe Leu Ala Glu Glu
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His Ser Ile Gly Ala Val Glu Leu Ile Ala Ile Asp Cys Val Pro Glu
580 585 590

Glu Met Gln Pro Ser Ala Arg Ile Lys Val Tyr Val His Thr Met Ser
595 600 605

Asn Ser Phe Gln Thr Val Arg Lys Tyr Met Thr Met Gly Gly Arg Cys
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Met Asp Pro Ala Thr Leu Glu Gly Leu Glu Asn Leu His Asp Val Trp
625 630 635 640

Tyr Ser Leu Leu Gly Glu Ser Gln Gly Ile Val Asn Glu Glu Tyr Ser
645 650 655

Lys Pro Leu Thr Gly Phe Ser Ser Met Gln His His Leu Tyr Phe Ser
660 665 670

Tyr Glu Met Thr Pro Gly Asn Ala Asp Pro Gly Val Lys Val Tyr Ile
675 680 685

Pro Val Gln Ser Tyr Ala Pro Asp Asp Lys Thr Ile Ala Gln Asn Tyr
690 695 700

Glu Ala Asn Phe Arg Gln Leu Asn Trp Pro Trp Gly Glu Pro Gly Val
705 710 715 720

Tyr Glu Ala Val Ile Glu Ser Ala Leu Gly Pro Val Lys His Ser Arg
725 730 735

2007-04-12 Sequence Listing-JAMES68.016APC.txt

Ala Thr Phe Leu His Gly Gly Ser Ser Phe Ile Phe Ser Lys Gly Arg
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Gly Val Tyr Gln Ser Ile Tyr Leu Asp Pro Pro Leu Glu Glu Gly Gly
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Leu Gly Asn Met
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Val Gln Trp Leu Ala Glu Thr Phe Val Thr Phe Met Gly Leu Gly Trp
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20

25

30

Leu Ile Asn Tyr Val Leu Met Ile Trp His Ser Arg Arg Gly Glu Pro
35 40 45

Ser Ser Met Ala Leu Ile Pro Leu Cys Asn Asn Ile Ala Trp Glu Leu
50 55 60

Val Tyr Thr Ile Ile Tyr Pro Ser Pro Asn Lys Val Glu Leu Ala Ala
65 70 75 80

Phe Ile Ala Gly Val Thr Leu Asn Phe Leu Ile Met Thr Ser Ala Ala
85 90 95

Arg Ser Ala Arg Ser Glu Trp Ser His Ser Pro Thr Met Ala Lys His
100 105 110

Ala Gly Leu Ile Ile Val Ala Gly Ile Leu Met Cys Phe Thr Gly His
115 120 125

Val Ala Leu Ala Met Glu Ile Gly Pro Ala Leu Ala Tyr Ser Trp Gly
130 135 140

Ala Val Ile Cys Gln Leu Ala Leu Ser Ile Gly Gly Val Cys Gln Leu
145 150 155 160

Leu Gln Gln His Ser Thr Gly Gly Thr Ser Trp Lys Leu Trp Ser Ser
165 170 175

Arg Phe Leu Gly Ser Cys Cys Ala Val Gly Phe Ala Phe Leu Arg Trp
180 185 190

Arg Tyr Trp Pro Glu Ala Tyr Gly Trp Leu Ala Ser Pro Leu Ile Leu
195 200 205

Trp Ser Leu Ala Thr Phe Leu Val Ala Asp Leu Thr Tyr Gly Val Cys
210 215 220

Leu Leu Leu
225